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Community-based monitoring

in the context of sustainable wildlife management and biodiversity conservation in tropical countries

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Community-based monitoring in the context of sustainable wildlife management and biodiversity conservation in tropical countries

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Community members from Rewa village record arapaima (Arapaima gigas) by a lake in the Rupununi region of Guyana

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Introduction

Across the world, billions of people, particularly Indigenous Peoples and local communities (IP&LCs), benefit from the use of wild animal species for food, cultural sovereignty, medicine, energy, income and many other purposes (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services – IPBES, 2022). However, with growing human populations, technological changes and the emergence of a booming commercial wildlife trade, the unsustainable harvesting of wildlife has caused significant declines in wildlife populations (Benítez-López *et al.*, 2017). This may result in profound ecosystem changes, including local extinctions and the loss of ecological services critical for humanity (Terborgh and Estes, 2010; Dirzo *et al.*, 2014; Darimont *et al.*, 2015; Ripple *et al.*, 2016, 2017; Young *et al.*, 2016). Globally, wildlife harvesting is considered the second major driver for biodiversity loss (Mayor *et al.*, 2022), behind the loss of suitable habitats for wildlife (IPBES, 2019), and together with other factors such as climate change, pollution and invasive alien species (WWF, 2022). For IP&LCs, who rely on wildlife for their livelihoods, ensuring sustainability of the use of wild animal species and the conservation of healthy ecosystems is critical to the maintenance of their traditional identity and key to reversing the global trend in biodiversity decline.

At the Kunming-Montreal CBD COP 15, parties agreed on a set of 23 action-oriented global targets for urgent action to achieve biodiversity conservation goals for 2050. Within this framework, there is growing recognition that biodiversity conservation and the sustainable use of wildlife cannot be achieved without fostering increased community stewardship for biodiversity. Recommendations from the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 26) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2022 report highlight the need for long-term community-based monitoring processes. In fact, Indigenous Peoples and local communities have been monitoring the state of nature in their lands and waters for millennia based on their profound tacit knowledge, rich heritage and contextually grounded understanding of their environment that often surpass many scientific methods. Nevertheless, to align with international and national policies, there is a growing need to record this knowledge in a way that can be used to document the dynamics within terrestrial and aquatic ecosystems. Communities engaged in biodiversity conservation and sustainable wildlife management are encouraged to develop long-term and formal monitoring systems as an integral part of their management systems to enable informed internal decision making on biodiversity and natural resources.

Despite growing international policy recognition for the need to encourage community-based monitoring programmes, the reality in practice remains far from commitments. To address this gap, growing guidance is required to support IP&LCs in the development and implementation of community-based monitoring systems. In 2024, the Transformative Pathways Project produced a practical guide for local organizations which are facilitating IP&LCs to design and implement environmental and biodiversity monitoring activities on their lands (Newing *et al.*, 2024). While the aforementioned guide provides very detailed information on how to facilitate the development of community-based monitoring systems, there is still ample room to enrich skills and knowledge based on practical insights gained from the empirical application of community-based monitoring in tropical forest and savannah ecosystems.

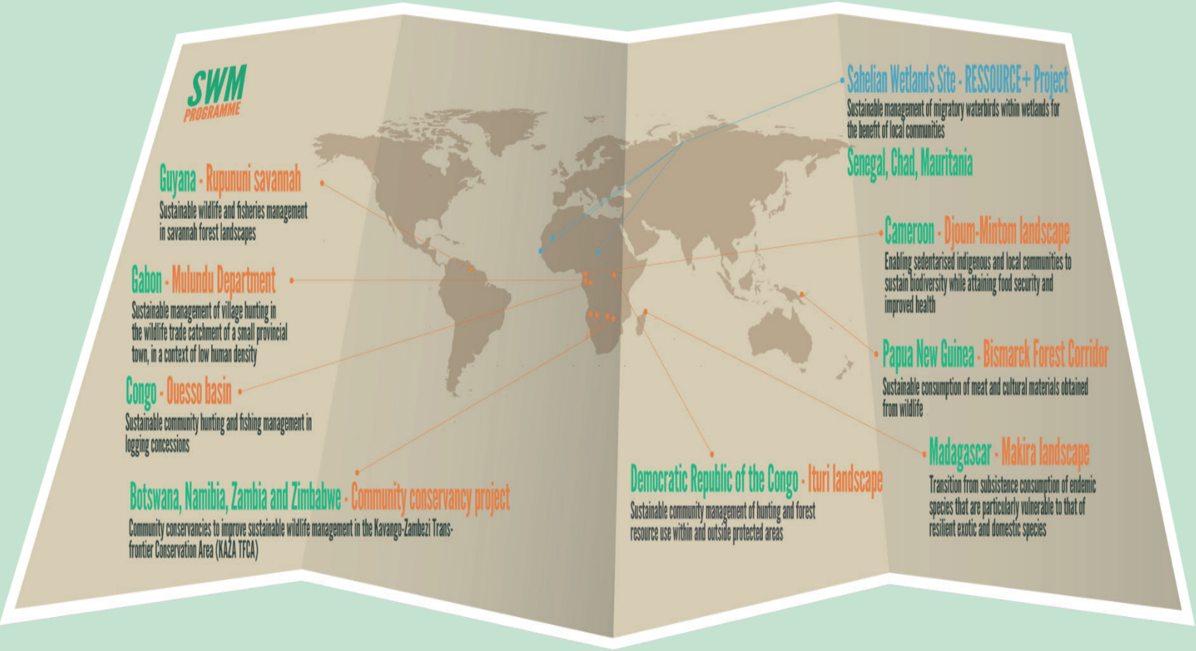
To fill this need, we have produced this concise document, for communities and their partners, with main key lessons learned that emerge from the implementation of community-based monitoring in the context of wildlife management and biodiversity conservation, across 15 countries in Africa, the Guyana Shield and the Pacific Region in which the Sustainable Wildlife Management Programme (Box 1) is implemented. The examples involve diverse forms of community-based monitoring and include different ecosystems (forests, savannahs, wetlands) and taxonomic groups (birds, mammals, reptiles, amphibians and fish). We further provide a more focused description of five case studies, including the multitaxa community-based monitoring process implemented by community wildlife and fisheries committees in the Rupununi (Guyana), the human-wildlife coexistence monitoring programme implemented by communities in Mucheni Community Conservancy (Zimbabwe), the co-managed monitoring system implemented for sustainable hunting around Lastoursville (Gabon), and the citizen science process implemented in communities around the Dja Reserve (Cameroon) to monitor and alert emergence of zoonotic diseases and the community-based monitoring system implemented in Namibia in the context of community-based conservancies (Namibia).

As explained later in this document, there are a number of prerequisites for defining and implementing community-based monitoring. For example, rights-holding communities must have the legal authority and resource rights to use the resources in their customary areas, as well as effective governance systems to exercise that authority, if community-based management is to work. Similarly, the objectives and scope of wildlife management need to be defined before a community monitoring system can be set up. These minimum requirements are set out in a technical brief entitled "What do we mean by community-based sustainable wildlife management?", which is available online and can be referred to by the reader if necessary.

Box 1: The Sustainable Wildlife Management Programme

The Sustainable Wildlife Management (SWM) Programme is a major international initiative that aims to improve wildlife conservation and food security. The programme is developing innovative, collaborative and scalable new approaches to conserving wild animals and protecting ecosystems, while at the same time improving the livelihoods of millions of people who depend on wild meat for food and income, in particular Indigenous Peoples and rural communities (IP&LCs).

Since 2018, the SWM Programme has been improving the conservation and sustainable use of wildlife in forest, savannah and wetland ecosystems. Field projects are being implemented in 16 African, Caribbean and Pacific countries. The aim is to improve how **wildlife hunting** is regulated, increase the supply of sustainably produced **meat products and farmed fish**, strengthen the **management capacities** of Indigenous and rural communities and reduce **demand for wild meat**, particularly in towns and cities.



Guyana - Rupununi savannah
Sustainable wildlife and fisheries management in savannah forest landscapes

Gabon - Mulundu Department
Sustainable management of village hunting in the wildlife trade catchment of a small provincial town, in a context of low human density

Congo - Ouesso basin
Sustainable community hunting and fishing management in logging concessions

Botswana, Namibia, Zambia and Zimbabwe - Community conservancy project
Community conservancies to improve sustainable wildlife management in the Kavango-Zambezi Trans-frontier Conservation Area (KAZA TFCA)

Sahelian Wetlands Site - RESSOURCE+ Project
Sustainable management of migratory waterbirds within wetlands for the benefit of local communities
Senegal, Chad, Mauritania

Cameroon - Djoum-Mintom landscape
Enabling sedentarised indigenous and local communities to sustain biodiversity while attaining food security and improved health

Papua New Guinea - Bismarck Forest Corridor
Sustainable consumption of meat and cultural materials obtained from wildlife

Democratic Republic of the Congo - Ituri landscape
Sustainable community management of hunting and forest resource use within and outside protected areas

Madagascar - Makira landscape
Transition from subsistence consumption of endemic species that are particularly vulnerable to that of resilient exotic and domestic species

OPEN HOLES
CLOSED HOLE
NOTES

Muduva Nyangana game guards recording spoors in the ‘event book’, used across Namibian CCs to monitor record ecological data and track fauna and flora species of interest.

© WWF

Why is community-based monitoring important?

IP&LCs monitor their lands and resources through different forms of tacit knowledge generated from practice of place, observations made on daily nature-based activities such as hunting, fishing and gathering and the transmission of accumulated knowledge from one generation to the other (Lam *et al.*, 2020). This incredibly rich knowledge often exists in intangible formats, and depends heavily on oral forms rather than textual statements. Its transmission is uneven across the community members, and is dependent on gender, age, occupation and social status, among others. Given its nature, traditional knowledge cannot easily be aggregated at different scales and is sometimes limited in generating cross-generational trends, given the "shifting baseline syndrome", an unintentional process by which each generation considers as a baseline the state observed at the beginning of their lives or careers, and uses this baseline to evaluate changes over time. Moreover, many IP&LCs across the world have already experienced the loss or erosion of their traditional knowledge systems, influenced in particular by other sources of more dominant knowledge forms, cultural transformations and changes in lifestyle (Fernández-Llamazares *et al.*, 2021). The loss of local knowledge often results in a diminished ability to understand environmental alterations across time.

For all these reasons, tacit knowledge may not always suffice to generate information for management and more explicit forms of monitoring may have to be put in place, such as through a community-based monitoring system. In some contexts, communities may even have the legal or contractual obligation to demonstrate outcomes through a locally based monitoring system, sometimes in combination with other existing means of verification. This obligation might come with the devolution of rights and be stipulated in legal frameworks, or be linked to contractual agreements, such as those related to co-management models, carbon and biodiversity credits or diverse forms of payments for environmental services.

Community-based monitoring is an explicit form of monitoring designed to be informed by the traditional practices and observations that have long been effective in Indigenous Peoples' and local communities' contexts, but recognizes the value of diverse knowledge systems in contributing to sustainable and effective management practices (Pollock and Whitelaw, 2005). It is a system that provides ample room for traditional ecological knowledge, but also incorporates varying levels of scientific inputs in the definition of indicators, and in the way in which information is recorded, stored and structured to derive useful information on changes occurring in the system and allowing for a more holistic and effective strategy. Through community-based monitoring, community members are empowered and trained to monitor their territories and natural resources, using co-produced indicators and a mix of traditional knowledge and innovative tools and approaches, while exercising their legitimacy to participate in data collection, own the information, contribute to internal learning processes, and participate in informed decision making (Latulippe and Klenk, 2020; Newing *et al.*, 2024). In short, community-based monitoring is a system that promotes evidence-based policy-making while empowering communities to steward decision-making processes (IPBES, 2022).

Implementing a community-based monitoring system might be particularly useful in contexts where:

1) communities have to demonstrate proper management in order to claim or maintain their rights over land and resources;
2) evidence is required to provide tangible results, accountability and transparency towards external actors;
3) showcasing evidence among community members is necessary to strengthen trust or protect the most vulnerable from arbitrary/biased decisions by elites; and/or
4) collective decision making needs to be supported for long-term planning decisions, tracking compliance to plans and rules, or alerting in case of abnormal events.

Iwokrama Rain Forest
Georgetown
GUYANA
Apoteri

Rewa and Katoka fisheries committee members deciding on biodiversity monitoring sites within their community land

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Key lessons learned for successful community-based monitoring in the context of sustainable wildlife management and biodiversity conservation in tropical countries

Lesson 1

Successful community-based monitoring is dependent on community stewardship, but also enhances it

By definition, community-based monitoring can only be successful if communities are stewards of their monitoring systems. Community stewardship is obtained when the community as a whole (and not just a few community members) have been given the opportunity to participate and steer decision making at all steps in the development and implementation of the monitoring system through appropriate processes to maximize participation (Wehn and Almomani, 2019). Communities that are at the forefront of wildlife management and biodiversity conservation within their territory[1] may naturally identify the need to self-establish a monitoring system of the status of various territorial components and adopt a leadership role in its development. Within those communities, the type and number of persons legitimately involved in steering the monitoring system is dependent on the cultural and social composition of the community in each place and the context in which the monitoring system is established. The monitoring system may be steered by locally elected or designated leaders, special interest groups within the community (e.g. hunters or fishers), community influencers or community NGOs, but must always involve community consultation (Conrad and Hilchey, 2011). In some cases, the whole community is involved in all steps of decision making. In cases where the community lacks the capacities or interest to self-engage in a monitoring system, the establishment of a community-based monitoring system may be led by external organizations, or by individual champions within the community who may have influence in their community but may not be authorized to represent them. In those cases, the monitoring system is developed mostly externally but aims at gradually involving community members in as many steps as possible to generate local capacities, foster interest and care, and support the community's agency over their territory and resources. In those circumstances, the community-based monitoring system can only become sustainable once communities have gained full stewardship over their monitoring systems. A stakeholder analysis (Vogler *et al.*, 2017) may support the identification of persons or groups within and outside the community that are authorized to participate in the development and implementation of the monitoring system. A community rights-based approach(CRBA) will provide guidance in which stakeholders should be included and the process in which they should be consulted for decision making (Box 2).

There are a number of conditions that either support or constrain community stewardship. **Agency, care and knowledge are the main necessary conditions for a community to steward its social-ecological monitoring process.** The level of stewardship of communities in a monitoring system varies according to the level at which the community has agency to manage and take decisions over its territory and resources, the level of care placed by the community in its territory and natural resources, and the level at which local or traditional knowledge has been maintained to inform decision making (Enqvist *et al.*, 2018; Shephard *et al.*, 2023). Agency refers to the ability and power a community has to make decisions about its own territory and resources. **Agency** is determined by the governance structures in place (institutions and norms) that empower communities to implement their knowledge and skills in pro-environmental behaviours. This is generally assumed to mean that management authority is devolved by higher-level government. More generally, agency is about having the authority to govern, having the capacity to enforce governance rules and regulations in a virtuous manner (e.g. no elite capture), and having the power to prevent powerful economic and political actors from usurping their governance authority and disregarding with impunity their rules and regulations. **Care** emerges from the way people derive significance, attitudes, symbols, principles and emotions from nature and wildlife (West *et al.,* 2018). Care is the emotional and cultural attachment a community has toward its natural surroundings. Care is continuously nourished through the positive attributes assigned to nature and wildlife. Lack of care is unusual among Indigenous Peoples and local communities, but loss of care and stewardship may occur among the younger generations or where embedded consumptive use of wild nature is no longer the primary source of physical wellbeing (Shephard *et al.*, 2024). **Knowledge** (and skills) arises from traditional practices or tasks and is acquired under the tutelage of wise mentors. Knowing how to subsist efficiently in a natural environment not only requires unique and site-specific knowledge but also the capacity to use this knowledge through practical skills and the ability to understand beliefs, rules, taboos and the cosmovision of a society. Depending on the context, agency, care and knowledge may have been partially or totally eroded through external factors such as forest degradation or wildlife loss, conflicts, colonization, migrations, relocations, natural disasters or market integration.

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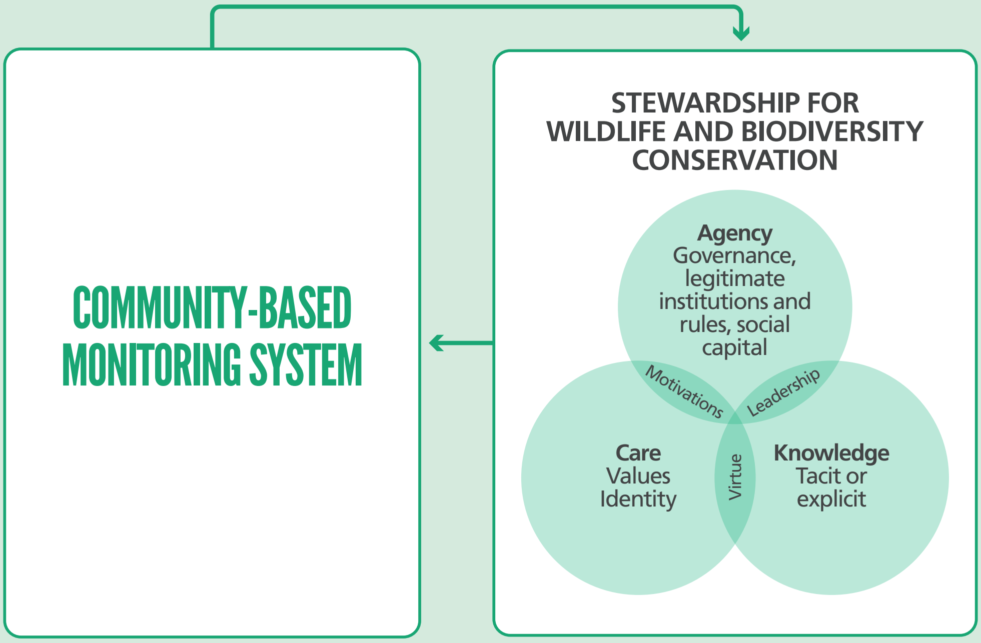
[1] A territory is understood broadly as the combination of interactions among space, living beings, natural and artificial objects, and geographical forms where values, social interactions, power relationships, cultural constructions, identity and interpretations emerge (Gieryn, 2000).

While successful community-based monitoring is dependent on community stewardship, there is also an inverse feedback loop whereby community-based monitoring may also help consolidate stewardship (Fernandez-Gimenez *et al.*, 2008). **Community-based monitoring may be a means to re-enforce agency and help obtain legal authority over land and resources** by ensuring wider visibility and promoting the recognition, at various geographical scales, of the key management role that communities may play in wildlife management and conservation. As opposed to tacit traditional knowledge, the community-based monitoring system generates information that can be shared and understood from outside the community by a wider audience, including government. In contexts where communities do not have formal recognition of their land and user rights but maintain care and traditional knowledge about their traditional territory, having the means to demonstrate that the community is able to manage land and resources sustainably may help make a case for the formal recognition of community territorial tenure and rights. For example, in Gabon, communities have established hunter associations, village-level hunting plans and a hunting monitoring system to demonstrate their management capacities to the Ministry of Environment and secure their hunting rights and quotas for commercial wild meat trade within their customary land.

In addition, monitoring may become a means to conserve, perpetuate or recover care over the territory and knowledge related to natural resources within the community. Indeed, by involving community members, particularly the younger generation, in generating useful information for wildlife management, communities can establish a virtual circle of care, respect and responsibility over their natural resources and restore or perpetuate local knowledge and sense of place. For example, in Guyana, communities in North Rupununi have established wildlife clubs, in which the younger generation is tasked to monitor birds within the community land, thereby fostering care and knowledge over birds and their habitats and generating bird watching capacities that are used for tourism development.

FIGURE 1. Virtual feedback loops between community stewardship for wildlife management and biodiversity conservation and the community-based monitoring system


COMMUNITY-BASED MONITORING SYSTEM
STEWARDSHIP FOR WILDLIFE AND BIODIVERSITY CONSERVATION
Agency
Governance, legitimate institutions and rules, social capital
Motivations
Leadership
Care
Values
Identity
Virtue
Knowledge
Tacit or explicit

Box 2: Community rights-based approaches in the context of community-based monitoring systems for wildlife and biodiversity conservation

The CRBA in the context of wildlife management and biodiversity conservation ensures that management and monitoring objectives are reached through empowering rights holders to claim and exercise their rights, and strengthen the capacity of duty bearers, who have a particular obligation or responsibility to respect, protect and fulfil these rights. The CRBA approach ensures equitable participation and inclusion of rights holders in all project activities, empowers them in their legal use and sustainable management of natural resources, and strengthens their capacity to manage and benefit from wildlife.

The Sustainable Wildlife Management (SWM) Programme has developed a CRBA to be adapted at project sites, and produced five social safeguards tools that can be used to operationalize it: *community rights situation analysis; Free Prior and Informed Consent (FPIC); Grievance Redress Mechanism (GRM); and gender mainstreaming and research ethics.*

These tools establish a framework for collaboration between rights holders (community members) and duty bearers (local and national government, district councils and local NGOs), as well as a practical step-by-step approach for duty bearers, to further support communities in their desire to monitor their territories and resources while actively seeking ways to support and promote their human rights.

In the context of community-based monitoring, the CRBA enables community members to fully participate in every step of the process from design to data collection, identification of indicators, analysis, presentation of results and management, ensuring the long-term sustainability of the monitoring system. The approach also helps improve local capacities and fosters engagement in decision making.

Lesson 2

Communities do not work in isolation: duty bearers, such as government, NGOs and researchers, may be involved and support the community-based monitoring system

Community stewardship over their monitoring systems does not imply that communities work in isolation and without collaboration. Depending on the context, the community-based monitoring system can be co-designed and co-implemented with support from governmental institutions, NGOs or academia. While uneven collaborations have negative impacts on community-based monitoring systems, collaborative partnerships may generate trust among stakeholders, enrich the level of knowledge, foster innovation, trigger exchange in technical expertise and contribute to financial sustainability. External actors should acknowledge the ways in which traditional monitoring already occurs, and value tacit knowledge as highly as explicit monitoring. On the other hand, communities should explore ways in which other sources of knowledge can complement or provide robustness to their tacit knowledge.

These collaborative partnerships may be particularly necessary in the context of co-management frameworks, where different constituencies are formally sharing roles and responsibilities in the management of wildlife and biodiversity conservation. For example, in Guyana, where Makushi communities have established a co-management plan with the Fisheries Department to manage the fisheries in the North Rupununi Wetlands, the Fisheries Department has been involved in the choice of indicators to assess changes in the fisheries system and is also involved in key aspects of the monitoring system, such as in monitoring Arapaima[2] stocks. The participation of the Fisheries Department is key, as based on the proposed Fisheries Act and co-management regulation; the Fisheries Department is responsible for issuing the sport fishing permits for Arapaima, while the community fisheries committee has the authority to formulate quotas and designate fishing zones. In Gabon, the officers of the Ministry of Water and Forests participate in data analysis on mammal abundance based on camera traps as part of a community-based monitoring system implemented by community hunters' associations, a process whereby trust is generated between the administration and local hunters, contributing to changing stigmas and enhancing collaborations for the sustainable management of hunting systems. In the Sahel region, where communities and governments are contributing to manage migratory birds at different management scales, the community-based monitoring system is integrated at national and international levels to foster cross-community and cross-national collaborations. In all these examples, stakeholders external to the community are involved in different ways to support the community-based monitoring programme.

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[2] Arapaima (*Arapaima gigas*) is the biggest fresh-water fish in the world. It lives in the Amazon River basin and the Guiana Shield. In Guyana, the species is protected through the Arapaima Management Plan.

Involving other stakeholders in the design and implementation of the monitoring system may diversify and enrich the sources of knowledge used to collect and understand the information. While traditional and local knowledge may be particularly appropriate to gain qualitative in-depth understanding of ecosystem health and species' interactions, the use of innovative technology or lab-based methodologies may be complementary, and more appropriate to meet verification requirements. A clever balance between different sources of knowledge is necessary to enrich communities' understanding of their territory and resources. For example, hunters around the Dja Reserve in Cameroon use traditional and local knowledge to identify and report on diseases observed in wildlife through a citizen-science reporting system, but they are also learning with academic experts to identify diseases based on clinically developed protocols. In Guyana, community fisheries committees assess the level of water quality through the colour and smell of fish and the number of dead fish found in fishing grounds, but also learned with researchers how to use standard water quality kits to measure dissolved oxygen, pH, temperature and conductivity. In Namibia, the Namibian Association of Community-Based Natural Resource Management Support Organisations (NACSO) is promoting the **event book** system, a paper-based solution, that allows game guards from Community Conservancies with low literacy, but strong traditional and local knowledge of wildlife and the environment, to gather sophisticated data which are analysed and returned to communities as part of an adaptive management process.

Involving other stakeholders may also contribute to sustain monitoring efforts with financial support. In traditional monitoring, there is no additional labour cost to monitoring as it occurs coincident with food provisioning activities, such as hunting, fishing and gathering. Engaging in explicit community-based monitoring is likely to add costs that communities must be willing to incur. In some instances, the financial cost of monitoring might be covered by another external stakeholder or through a partnership in the context of wildlife-based economic activities. In community conservancies in Namibia, the community-based monitoring system is legally associated with the determination of a yearly quota by the government. As such, sport hunting revenues derived from the quota are directly invested into the community-based monitoring system. In Ouesso, Republic of the Congo, communities whose hunting grounds are located inside a certified logging concession (that has the obligation to demonstrate wildlife management efforts), are discussing the possibility to involve the logging company in providing the funding for the monitoring system. In Yangambi, Democratic Republic of the Congo, local communities have established a partnership with a local NGO, called SOWILD, for the implementation of wildlife credits that provide financial resources to cover the costs of the community-based camera trap monitoring system. Every year, the wildlife credit covers the monitoring costs and, in addition, provides a benefit for individual or community projects calculated based on the number of camera traps capturing vulnerable species. The system represents an incentive for hunters to preserve vulnerable species during their hunting trips while fostering care and concern for those species.

Lesson 3

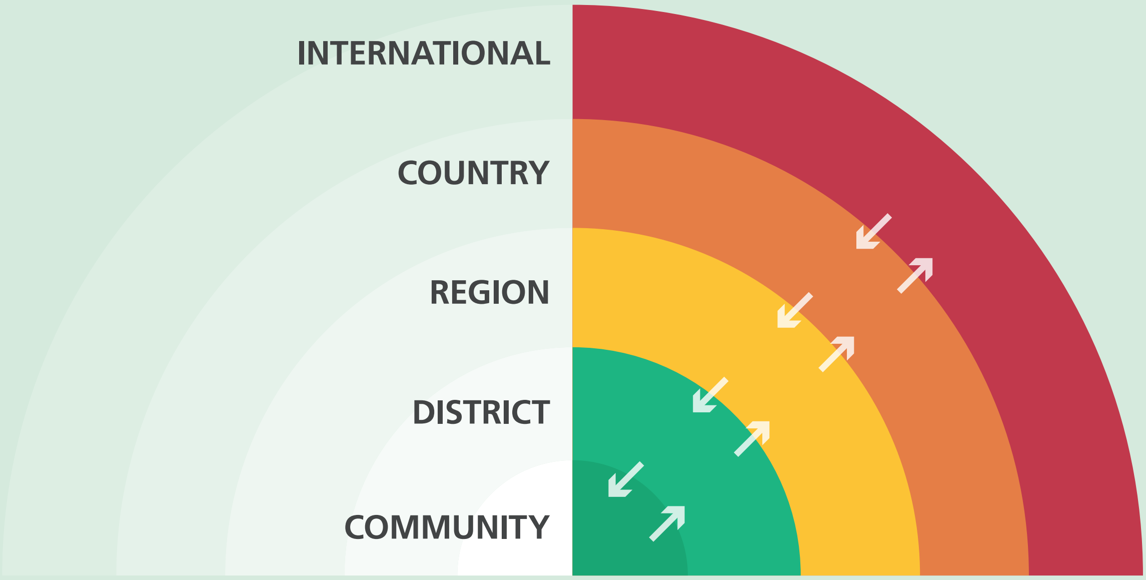
Objectives and scale must be defined prior to deciding on the tool for data collection

There is a general tendency to decide on the monitoring tool prior to defining the objectives, the scale and the indicators to be monitored. This is most often the case when the monitoring system is driven or prescribed by external actors or when there is a trendy methodology that communities (or their collaborators) are eager to test. For example, when a decision (external or community driven) is made to establish a camera trapping monitoring system without involving the community upstream more widely in identifying which data are needed to inform which specific management decision-making process, there is no proper consultation process in place and the cart is simply put before the horse. The objective of the monitoring, the type of data needed and the scale at which the data should be generated should be decided by the community in the first place. Then, community members can discuss and decide which is the most appropriate method to generate the data needed: methods can be very diverse and range from participant (to cite just a few) observation, camera traps, semi-structured surveys, and participatory mapping, to transects depending on the indicator chosen and the financial and human resources available.

Identifying the objectives of the monitoring tool beforehand is important as it will embed the system into a decision-making process from the inception. This will guarantee that the system is not generating information for the sake of accumulating information, but rather to inform very tangible management processes. For example, in Katoka, a Makushi community in Guyana, the monitoring of river water levels will indicate whether the relocation of turtle nests will be necessary to avoid flooding of nests, and at which distance from the water level nests should be relocated. In Binga's Mucheni Conservancy in Zimbabwe, the monitoring of human-wildlife conflicts will inform measures that can be taken to mitigate conflicts, in particular the establishment of a Human-Wildlife Conflict Relief fund which will be used to compensate for loss of life or property. In the community of Kabo, in Republic of the Congo, the monitoring of hunter offtakes has helped enrich the discussion over hunting rules at the community level and has already motivated hunters to propose a rule on the maximum number of cartridges that hunters can carry on a hunting trip.

Discussing the scale at which data are collected is crucial, as it must align with the objectives of the monitoring system and correspond to a management unit that has been mutually agreed upon. While this recommendation sounds trivial, in the rush and enthusiasm to implement a monitoring system, communities may not thoroughly discuss scale prior to identifying indicators. The choice of scale is related to the management unit. Scale has large implications and a mistake in the choice of scale may create a mismatch between the monitoring system and its objective. For example, Wapichan communities in South Rupununi wondered if their monitoring system should cover their titled land only, or if it should cover the whole extension of their customary land. While the legal framework only gives them the authority to manage resources within their titled land, communities have applied for a land title extension, and in that context, they decided to show they were taking care and managing their whole customary land, and, as such, chose to extend their monitoring system beyond the legal limits of their titles. On the contrary, around the Makira Natural Park, in Madagascar, communities are monitoring hunting and fishing at the level of each COBA (Communauté de base), which corresponds to one or several villages grouped together, and responds to the scale at which the government provides contracts for the transfer of management rights over natural resources. In this example, the management unit is determined by the legal framework. In many cases, community-based monitoring systems may have embedded scales, where the minimum unit is the clan or the community, but data are then compiled at the level of a group of communities and potentially also at regional and national levels. This is the case in Namibia, where each conservancy manages a community-based monitoring system, but data are then compiled at national level to decide on hunting quotas.

FIGURE 2. Diversity of scales in community-based monitoring for embedded systems



Lesson 4

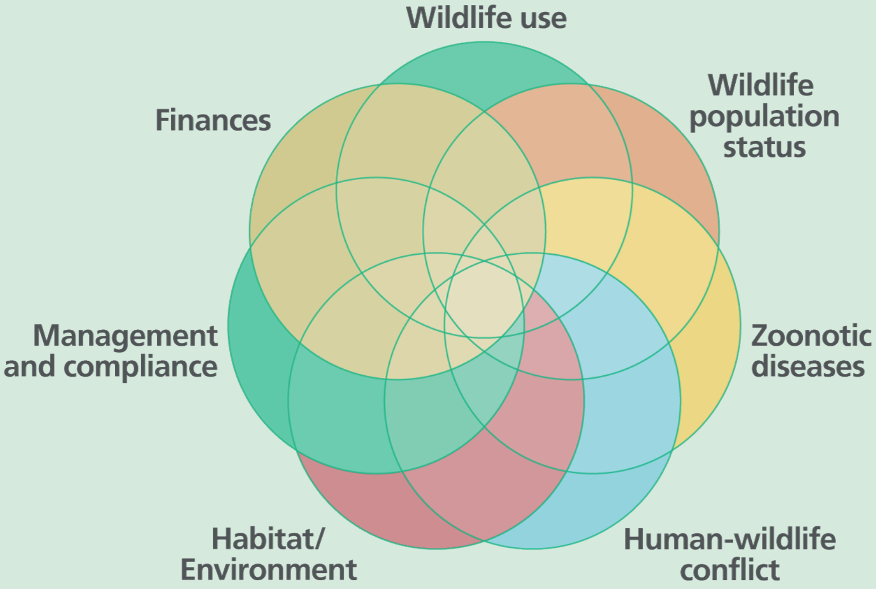
The choice of indicators needs to be representative of communities' cosmovision and the desired state of the management system

Once the objectives and scale are defined, the next step is to discuss the indicators that should be monitored. Most monitoring systems use a set of indicators or multiple metrics because the use of multiple indicators can reduce biases in each indicator and confirm trends. For indicators to be useful, the number of indicators should be limited, well related to the monitoring objectives, and their associated methodologies should be adapted to the analytical skills and financial and logistical resources available to the community.

Most importantly, the choice of indicators must take into consideration the way in which communities interpret the world and their territory. Considering communities' cosmovision is important because, as opposed to scientific approaches, which are usually segmented by disciplines, Indigenous communities often view the world as an interconnected system of complex interactions among space, living beings, natural and artificial objects, and geographical forms where values, social interactions, power relationships, cultural constructions, identity and interpretations emerge. While managers may understand wildlife management as a binary interaction between how humans use and impact animals or as to how animals contribute or generate impacts on humans, local communities understand the management of wildlife as an integral part of the management of their territory, understood as a multidimensional concept consistent with the realization of the right to their self-determination in defence of their ancestral lands, resources, culture, ways of life and political organization. Understanding wildlife as part of a territorial approach has important implications for community-based monitoring systems for wildlife management and biodiversity conservation, and suggests that indicators cannot be chosen in isolation from the wider components of a territory, including its geographical and geopolitical boundaries, its people, its habitats, its cultural constructions and its wildlife. When community members in the Wapichan Wiizi, in Guyana, were brought to think about how they interpreted a healthy wildlife system, they did not just think about the status of wildlife populations. They suggested that a healthy wildlife system is one that can continue to provide them with food, medicine and income, one where habitats provide enough security and food for abundant wildlife, one where the traditional owners of the territory have the capacities and the authority to decide and make decisions about the land in which wildlife strives, one in which people care about wildlife and have wildlife embedded within their cultural identity. Choosing appropriate indicators may therefore require the community to imagine scenarios and describe in their own words a desired state of the management system. As a corollary, indicators will most likely emerge from a combination of traditional and local knowledge and other sources of information.

In addition, the choice of indicators should be based on how the community would like to see its territory and its biodiversity in the future, and a consensus with regards to the changes required to achieve the desired state. Envisioning a desired future, defining criteria to describe this desired future and discussing the changes required will help in identifying where the problems or risks lie and therefore adapt the monitoring indicators to the right issue. For example, in communities near Lastoursville in Gabon, monitoring inland fisheries was more about monitoring water quality because the constraint, as identified by communities, was not the sustainability of the harvest but the quality of the ecosystems, given the risk of pollution from mining (e.g. mercury) and consequences for water turbidity and temperature. In North Rupununi, communities concerned about the sustainability of river turtle populations monitor traffic of outboard engines, water level conditions and predation of nests, along with human consumption of eggs and turtles, because they perceive that turtle populations are sensitive to a diversity of drivers including river traffic, weather patterns, natural depredation and human offtakes. In Binga's Mucheni Community Conservancy in Zimbabwe, communities monitor fire and water availability, as they perceive that those factors influence wildlife populations as much as poaching.

FIGURE 3. Examples of criteria used to define a desired state in a wildlife management and biodiversity conservation system



Lesson 5

Too much data may kill the information: useful data will more likely be closer to the minimum necessary rather than to the maximum possible

Monitoring systems frequently collect more data than are ever analysed or useful. This outcome happens when the list of indicators has not been thoroughly defined upstream and data are collected on as many interesting aspects as possible. It also happens when a methodology is proposed prior to defining the indicators to be monitored. For example, when developing a semi-structured interview to monitor the hunting sustainability in a given community, one could be tempted to include as many questions as possible to help understand the hunting system (e.g. hunting practices, hunting effort, hunting offtakes, etc.). Without a subsequent phase to reduce the number of questions to those that are strictly necessary, the data, which will be collected on a regular basis, are likely to generate large amounts of datasets (paper-based or soft copies). However, only a few of the questions asked will subsequently be used as part of the decision-making process that the monitoring system is designed to support. As a general rule, the list of indicators should not be based on what is interesting to know or the maximum possible information one can get, but rather on the minimum necessary amount of information that is useful for management.

Accumulation of useless data not only represents a waste of resources, but also reduces the effectiveness of the monitoring system, and could discourage the community from using these tools. Comprehensive data sets are not necessarily complex or large. When developing a set of indicators and related methodologies, communities should simplify them to the minimum necessary prior to implementation. Simple monitoring systems, based on a small number of sensitive indicators, provide good explainability value. In Gabon, hunting associations initially implemented a comprehensive monitoring system with many indicators and partnered with a research institute to develop an automatized data analysis. However, subsequently, they also developed a much simpler system, one that communities manage without external support, and that only uses two indicators: offtake per hunter and offtake per hunting trip. The simpler monitoring system allows them to monitor hunting much more cost-efficiently based on a shorter list of indicators which provides robust information, is easily understood by hunters and does not imply high costs or human resources. In North Rupununi communities in Guyana, the community fisheries team in charge of the fisheries management plan initially established a comprehensive questionnaire to fishermen, households and local shops to follow fish offtakes, fish consumption and trade on a monthly basis across ten communities (including more than 30 questions), but later decided to simplify data collected by simply setting a monitoring checkpoint to monitor five indicators: number of vessels per fishing category; number of fish harvested for each of the most important species; number of fishing vessels using different types of gears; number of unlicensed small-scale and large-scale commercial fishers; and number of commercial fishing vessels found catching protected species.

Lesson 6

Verifiable and evidence-based community monitoring systems require standardization and scientific structure

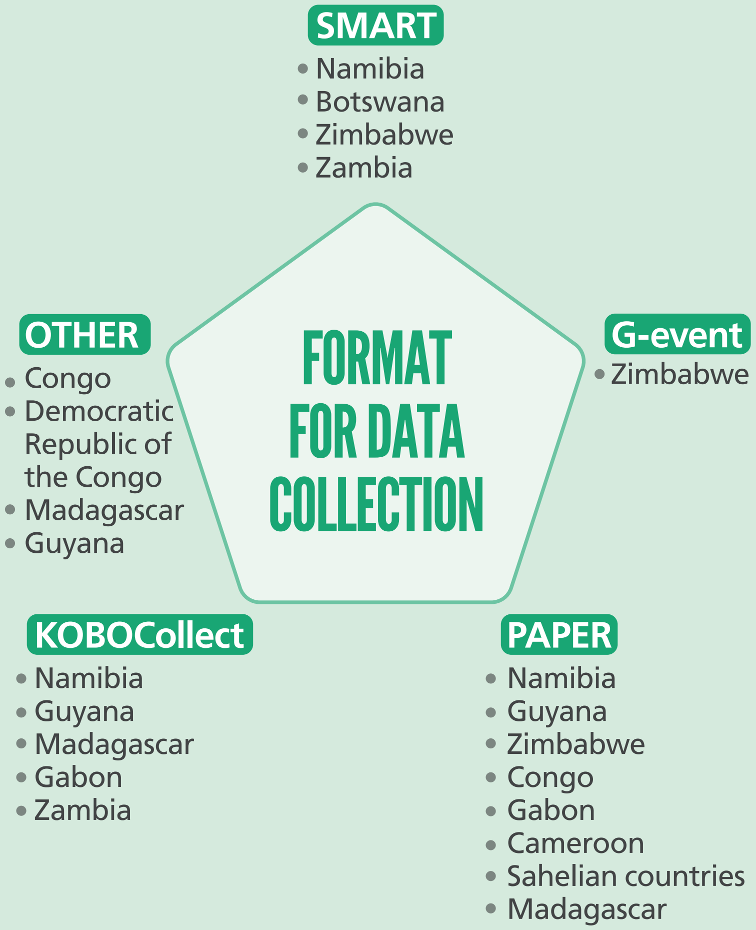
Community-based monitoring systems may require being evidence-based and verifiable, particularly when the monitoring system is responding to a legal or contractual obligation or when the objective of the monitoring system is to increase visibility and convince external stakeholders about the outcomes of management actions. At this critical stage, communities may require external support. Indeed, ensuring that the monitoring system follows a scientific structure may be the most difficult, time-consuming and technically demanding step in the development of the community-based monitoring system. Training in understanding the requirements for being repeatable and evidence-based is often needed at community level. In cases where the monitoring system must be verifiable and evidence-based, the monitoring system should be structured and based on methodological standards. Each of the indicators should be associated with a criterion or a desired state, a measurement unit, a methodology for data collection (e.g. method, frequency, scale, location), a format for data collection and storage and a team in charge of collecting, verifying and analysing data. In addition, indicators must show changes over time and will therefore require agreement as to when to set the baseline value and a measurement of the baseline value. In this context, indicators based on citizen science may only be useful if collected widely, repeatedly, by a wide range of citizens across the whole range of the monitored area, and if associated biases can be measured.

FIGURE 4. Guiding questions to ensure that the community monitoring system is verifiable and evidence-based

INDICATOR	MEASUREMENT UNIT	METHOD FOR DATA COLLECTION AND ANALYSIS **(tools, frequency, location, scale, software etc...)**	FORMAT FOR DATA COLLECTION AND STORAGE	RESPONSIBLE TEAM **(for data collection, analysis and verification)**
Is it linked to a criteria of desired state?		Is it cost effective	Paper based? Soft data? Recordings, videos, pictures? Maps?	Are skills available internally?
Does it contribute to your objective?		Does it use scientific and traditional/local knowledge as appropriate?		Can you partner with an existing team or organization to build your capacities?
Is a baseline value available?		Is it repeatable and verifiable?		
Is it measurable in an efficient manner?				

The format and tools for data collection and storage may vary according to each context, from paper-based to innovative apps, but may also include a diversity of formats adapted to the local context (Figure 5). In community monitoring systems, the range of possibilities is constrained by users' literacy levels. The tools employed must account for this to ensure maximum inclusivity. For example, hunters in Gabon monitor their offtakes on paper flip charts pasted on village signboards, where they indicate the species, and the number of animals hunted per month. In parallel, hunters also record their data on paper forms that are read automatically and integrated in a database using optical character recognition (OCR). The database is then used to produce automated reports that are tailored to the need of the communities to make decisions. In the Republic of the Congo, hunters are testing a methodology based on boxes to anonymously inform about the species and numbers hunted: each time they hunt a given species they insert as many stones as animals hunted in the box that is dedicated to that species. Fishers in Guyana monitor arapaima, the biggest freshwater fish, using wood sticks, during 20-minute counts. Arapaima surface to breathe every 20 minutes. So, during a 20-minute count, fishers cut long sticks when an adult surfaces and a shorter stick for juveniles. At the end of the 20 minutes, the fishermen count the total number of long sticks and short sticks to report on adult and juvenile population.

FIGURE 5. Format and tools for community-based data collection used in different sites in which the SWM Programme is implemented


SMART
• Namibia
• Botswana
• Zimbabwe
• Zambia
FORMAT FOR DATA COLLECTION
OTHER
• Congo
• Democratic Republic of the Congo
• Madagascar
• Guyana
G-event
• Zimbabwe
KOBOCollect
• Namibia
• Guyana
• Madagascar
• Gabon
• Zambia
PAPER
• Namibia
• Guyana
• Zimbabwe
• Congo
• Gabon
• Cameroon
• Sahelian countries
• Madagascar

Lesson 7

Mechanisms to analyse, communicate and influence must be in place beforehand to ensure that the monitoring system serves its purpose

Management-oriented community-based monitoring systems serve to inform and influence decision making regarding a wildlife management and biodiversity conservation topic.

Therefore, communities should define their impact pathway and outreach strategy prior to starting data collection to plan on how the availability of robust data will ultimately lead to decision making. Different steps are involved in this process:

1. How will data be analysed and by whom?;
2. How will the data be presented and by whom, in which format, in which language and to whom?;
3. How often should the data be shared and presented?;
4. Which events may be critical for outreach? The outreach strategy defines the wtarget audience, describes the settings and channels that will reach the target audience based on knowledge of needs, values and accessibility, anticipates potential obstacles and is tempered by the realities of available resources.

Each audience has different needs regarding the timing, frequency, level of technical detail, and preferred mode of communication. For example, hunters from associations around Lastoursville (Gabon) meet with their wider community and the agents of Ministry of Water and Forests four times a year to share and discuss the results of the monitoring system. Automated treatment of the data makes it possible to generate information reports on the life of their associations and the level of offtake they achieved since the beginning of the year, when they established their hunting objectives. That way, communities can adjust their hunting practices to stay on target. At the end of the year, the final information report is used to set updated objectives for the coming year. Channels for communication may involve radio, village meetings, stakeholder platform workshops, monthly newsletters, theatre and village sign boards, and should be as innovative and locally adapted as possible. For example, on a yearly basis, the community wildlife committees from Weko, Yaselia and Bosukulu, (in Yangambi, Democratic Republic of the Congo), use the results of the monitoring system to work together with the youth wildlife clubs in the development of a theatre script, which is then performed by the wildlife club, at the end of the school year, to the wider community. This is a fun way for the younger generation to share some of the main highlights from the monitoring system with the adult generation, who then participate in decision making. Ideally, communities should also regularly evaluate and reflect on their impact in an adaptive management process and adapt their impact and outreach strategy based on their achievements.

FIGURE 6. Impact-oriented outreach strategy

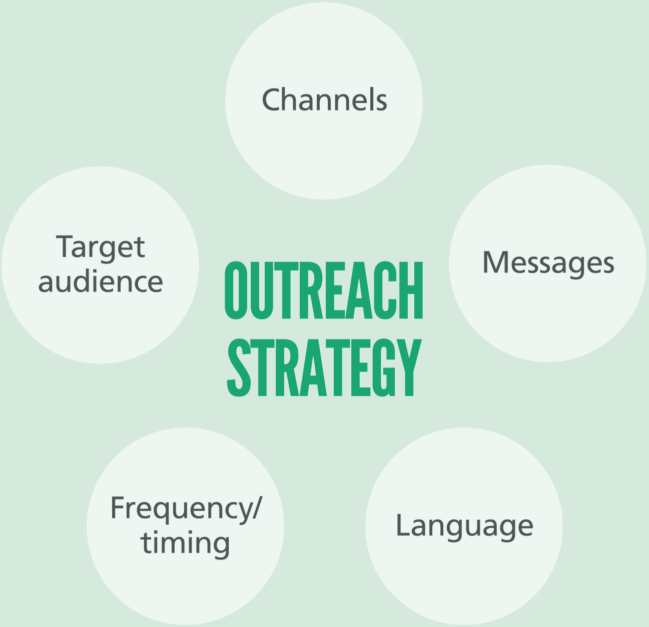
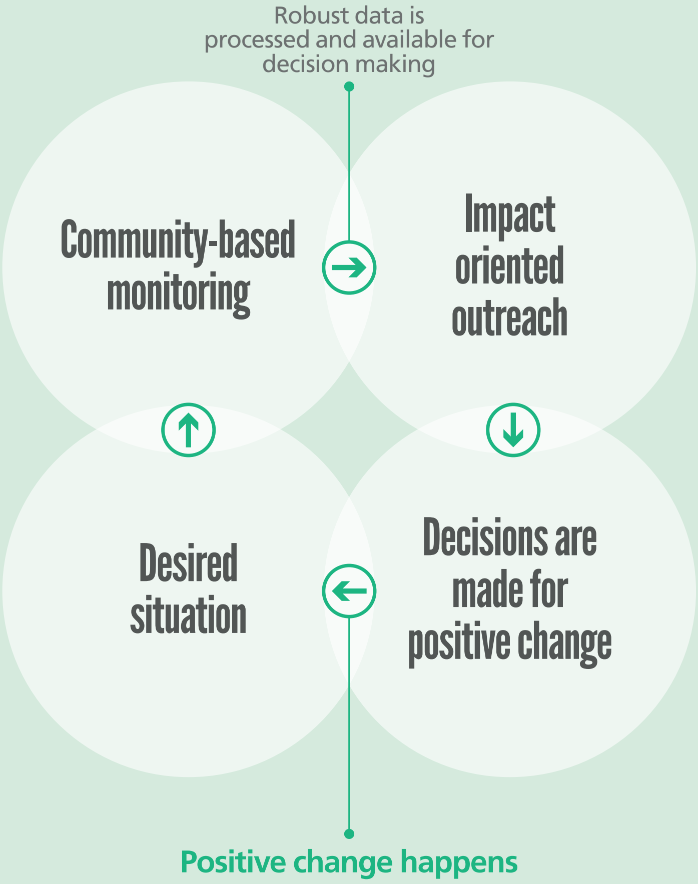

Channels
Target audience
OUTREACH STRATEGY
Messages
Frequency/ timing
Language

FIGURE 7. Impact pathway for the community-based monitoring system


Robust data is processed and available for decision making
Community-based monitoring
Impact oriented outreach
Desired situation
Decisions are made for positive change
Positive change happens

Lesson 8

Sustaining monitoring efforts over time requires financial resources, effectiveness, trainings and innovations

Once a monitoring system has been developed and tested, one of the major challenges is to ensure it can be sustained over time. **Financial resources to sustain a monitoring system may be a major constraint.** This is why it is important to design the monitoring system in a way that minimizes costs while maintaining the best possible quality of data. **Another major issue, often overlooked, is to ensure that community members maintain interest and enthusiasm over time.** The development and testing phase are exciting because they bring innovation and hope to the communities, but as monitoring is a repetitive process, the collection of data might become routine and the communities may lose interest in the information generated.

Ensuring constant learning, revisiting the monitoring tool to incorporate innovations, and employing new technologies and new approaches are important ways in which the teams can maintain enthusiasm and pride. Providing frequent feedback to the wider community is important to ensure that the monitoring does not represent a black box. Ensuring that the data are indeed used as part of an established impact pathway also generates trust in the usefulness of the monitoring system. Furthermore, establishing ways in which the younger generation can be involved to learn about the monitoring system from an early age is another way to ensure that the new generation can gain interest in participating in the process. For example, in the Guyana Rupununi, the community wildlife clubs propose afterschool programmes, not only to teach kids about sustainability, but also to introduce them to science and careers in wildlife management and conservation. The objectives of the clubs are to learn about wildlife and natural resources, develop skills in local wildlife surveys and wildlife monitoring, understand natural resource management and conservation and build personal capacity and social skills. Clubs provide members with the opportunity to develop environmental stewardship skills, while promoting their personal development and leadership.

Examples of application of a community-based monitoring tool in the context of sustainable wildlife management

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SWM SUSTAINABLE WILDLIFE MANAGEMENT PROGRAMME

Community-based Monitoring for terrestrial wildlife, turtles and fisheries in the Rupununi 2024

Name of community:

Supported by

Consortium of partners

AFD

Food and Agriculture Organization of the United Nations

CIFOR

World Agroforestry

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Case study 1

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The multitaxa community-based monitoring process implemented by community wildlife and fisheries committees in the Rupununi, Guyana

What is the objective of the monitoring system?

Communities and grassroots organizations across the Rupununi are pioneers in the sustainable use and conservation of wildlife in Guyana. Their efforts have led to the development and implementation of three grassroots management plans:

1) the North Rupununi wetlands fisheries management plan, which aims to sustainably co-manage fisheries in close collaboration with the Fisheries Department;

2) the regional turtle management plan, which aims at conserving and managing turtles and their nests through *in situ* and *ex situ* conservation measures and involves communities and the Protected Area Commission (PAC); and

3) the Wapichan Wiizi Wildlife Management Plan, which aims at consolidating Indigenous agency in the management of the Wapichan customary territory and its biodiversity.

Asaph Wilson, a bird expert, conducts monitoring in the Karaawaimin Tawaa

© FAO/Marlondag

As part of these management plans, long-term monitoring based on local and scientific knowledge was recognized by Indigenous leaders as key to generating information that can be used directly to inform management. The monitoring tool produced by community members is not intended as a research data collection tool. Instead, it focuses on collecting information that local communities have identified as key to informing their management decisions. It involved community members in all steps including design, data collection, analysis, presentation of results and management. The monitoring system is used by village wildlife and fisheries committees to monitor wildlife.

What was the development process?

Since the development and inception of the above-mentioned management plans, community members identified that monitoring by and for the community was a priority and an integral part of the management plans. Based on requests for support by Indigenous district-level organizations, the SWM Programme helped facilitate the development of a community-based monitoring system that could help inform the existing management plans. The community-based monitoring tool was developed in 2023, based on a series of three initial workshops, involving village fisheries and wildlife committee members, turtle monitors, village councils, grassroots organizations from South, Central and North Rupununi and governmental institutions (PAC, Guyana Wildlife Conservation and Management Commission [GWCMC], and the Fisheries Department [Ministry of Agriculture]). Subsequently, after a period of testing, another round of three workshops was organized to fine-tune the monitoring system, particularly with regards to the methodologies and the paper-based notebook designed for data collection and storage. Community members and governmental focal points were at the forefront of proposing the scale for data collection, the list of indicators, the methodologies for data collection, the frequency and location, and the format for data collection. The finalization process involved a process of testing and feedback from the community wildlife and fisheries committees, scientists, the district-level Indigenous organizations, governmental institutions and the SWM Programme team, which lasted for six months.

What indicators are monitored, and which methodologies are used?

The monitoring tool is structured around three themes: terrestrial wildlife, fish and turtles. Indicators were chosen to ensure efficient and cost-effective data collection, ensuring the long-term sustainability of the monitoring system. The choice of indicators reflects the way in which Indigenous communities in the Rupununi understand aquatic and terrestrial ecosystems, and include indicators of population status, ecosystem status, threats, traditional and commercial uses, management actions and compliance with local management rules and national legislation. Indicators also reflect the high level of training and exposure that community members in the Rupununi have had over the last decade in the use of technology and scientific tools and methodologies through various conservation and research programmes. The monitoring of terrestrial mammals and birds include 20 indicators which will be measured on a yearly basis based on camera trap surveys, point counts (birds), quarterly meeting interviews with households and quarterly interviews with trappers, data collected at the existing wildlife checkpoint and participant observation. The monitoring of fisheries includes 19 indicators, which will be measured based on arapaima counts, quarterly meeting interviews with households, water quality kits, river checkpoint data, fishing guides' interviews, patrols and participant observation. The monitoring of turtles includes 19 indicators measured based on nest monitoring, quarterly meeting interviews with households, participatory mapping and participant observation.

How are data collected and stored?

Data are collected by local-level wildlife and fisheries committees composed of four to six community members. Some indicators are collected all year long, while others are collected only once or a few times a year. Most indicators depend on season and as such the collection of data depends on each taxonomic group. For example, turtle nesting only occurs from January to April each year, and thus, monitoring is restricted to those months of the year. Data are input directly into a monitoring notebook specifically designed for data collection. Each year a new monitoring notebook is completed with information. The monitoring notebook is inspired by the Management Oriented Monitoring System used in Namibia, where cells are coloured whenever a new observation is made to ensure that the outcome of the data collection is readily visible without having to compute graphs on Excel. At the end of each year, the data generated by each community are input into the KoboCollect app to generate information at the co-management level.

Yupukari turtle ranges rescue turtle eggs from flooded beaches along the Rupununi River.

© CIFOR-ICRAF/Luke McKenna

How are results communicated?

Results from the monitoring system are shared at quarterly village meetings, yearly multistakeholder platform meetings and quarterly district-level meetings in the format of Power-point presentations. In addition, the results are also presented at the Wapichan Wiizi Wildlife Management platform meeting on a yearly basis. Local civil society organizations and district-level Indigenous organizations share important results with the relevant governmental organizations through various means and to the general public through their social media platforms. The results may guide interventions such as arapaima rescues from dry ponds during severe droughts, temporal and spatial bans on turtle harvest when turtle population drops, awareness campaigns when excessive garbage is observed on riverbanks, village leader interventions when illegal harvest is observed in community conserved areas, alert in case of illegal mining happening in Indigenous lands, fire control measures, etc. In 2025, the first "State of Wildlife and Biodiversity in the Rupununi" newsletter will be issued as part of a yearly initiative to communicate the results more widely.

What were the major difficulties encountered and how were they addressed?

The development phase of the monitoring programme was a difficult step, particularly with regards to defining the details of the methodologies for data collection and establishing a paper-based monitoring tool that could help visualize the outcome of the monitoring without having to rely on a computerized data analysis tool. A phased approach with multiple feedback loops was necessary between the SWM Programme team and the communities to ensure that the community-based monitoring tool was fit for purpose.

A community ranger observes and collects wildlife data as part of regular community monitoring in the Rupununi region of Guyana

© FAO/Marlondag

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Case study 2

The human-wildlife coexistence monitoring programme implemented by communities in Mucheni Community Conservancy in Zimbabwe

What is the objective of the monitoring system?

The Mucheni Community Conservancy in Binga District (Zimbabwe) offers a sustainable land-use option and empowers rural communities to coexist with wildlife. It also fosters the development of local skills and institutions for wildlife management. It builds on the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) that was successfully implemented in Zimbabwe and aims at improving the sustainable management of wildlife and domestic animals, introducing affordable and appropriate technologies to protect livestock and crops from wild animals and support sustainable fisheries and hunting practices that provide new livelihoods and sources of income. In this context, the community conservancy established a monitoring system for human-wildlife conflict to facilitate informed decision making about the implementation of a human-wildlife relief fund. The monitoring system enables the identification of problem animals, and areas mostly affected by human-wildlife conflict, and provides information and data to assist in decision-making processes to identify suitable mitigation measures.

What was the development process?

The development of the monitoring system started with support from the SWM Programme team, through a series of role-playing games used to integrate farmers' understanding of the Human-Wildlife Conflict (HWC) context into a strategy aimed at reducing the negative impacts of HWC. The process involved jointly drawing up a situational diagnosis, understanding the factors and aspects linked to their current context, defining a monitoring system and jointly-deciding on a roadmap on how to prevent and reduce the burden of HWC. The development of mitigation measures were based on responses from farmers through a participatory process (role-playing games and group discussions).

What indicators are monitored, and which methodologies are used?

The monitoring system focuses on the location of incidents, the number of people or livestock affected, the type of destruction observed, problem animals involved, mitigation measures applied at the affected site, and farmer identification details. Data are collected by 18 resource monitors supported by the SWM Programme to track conflicts as they arise.

How are data collected and stored?

Data are collected through the G-events monitoring app and SMART mobile application. Data are downloaded from the G-events and SMART mobile app, analysed and shared between district stakeholders and community environmental management committees.

Resource Monitors from local communities are training in wildlife data collection using the G-events and SMART apps. Mucheni Community Conservancy, Zimbabwe

© FAO/David Mansell-Moullin

How are results communicated?

The results are communicated through monthly reports that are shared with local authorities (Binga Rural District Council). Monthly summary reports are also shared at community level by Natural Resource Monitors. Wildlife Monitoring charts showing analysed monitoring data are displayed in Resource Monitors' offices where environmental committees are able to access human-wildlife conflict data and statistics.

What were the major difficulties encountered and how were they addressed?

The major challenge encountered during data collection was non-reporting of human-wildlife conflict incidents by community members. Community members felt that there was a delay in responding to HWC incidents by the local authority (Binga Rural District Council) and Zimbabwe Parks and Wildlife Management Authority (ZimParks). As a result, they concluded that reporting the incidents were a waste of time as there was no action taken. Non-reporting of incidents is still a major challenge; however, the SWM Programme, Binga RDC and ZimParks have introduced a hot-line (phone line) to enable communities to instantly report problem animals in their areas. The introduction of various mitigation measures (use of chili, bomas [enclosures], watch towers, trenches) by the SWM Programme has instilled hope and encouraged community members to continuously report human-wildlife conflict incidents.

Chipo Munsaka, one of the community Resource Monitors at the Mucheni Community Conservancy, prepares a monthly summary report that will be shared with the community. Zimbabwe

© FAO/David Mansell-Moullin

Case study 3

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The co-managed monitoring system implemented for sustainable hunting in Gabon

What is the objective of the monitoring system?

The hunting monitoring system has been implemented in ten communities in the department of Mulundu in Gabon with the objective of providing reliable information on the performance of the ten hunting associations, hunting levels and the sustainability of hunting.

The information generated is intended to inform the following stakeholders:

- the community: to make informed decisions regarding the management of the hunting association and the level of offtake locally agreed; and
- the authorities: to make recommendations in exceptional cases where communities fail to make sound decisions regarding the management of game species and to collect information regarding the state of game species populations at the district level in order to set quotas.

What was the development process?

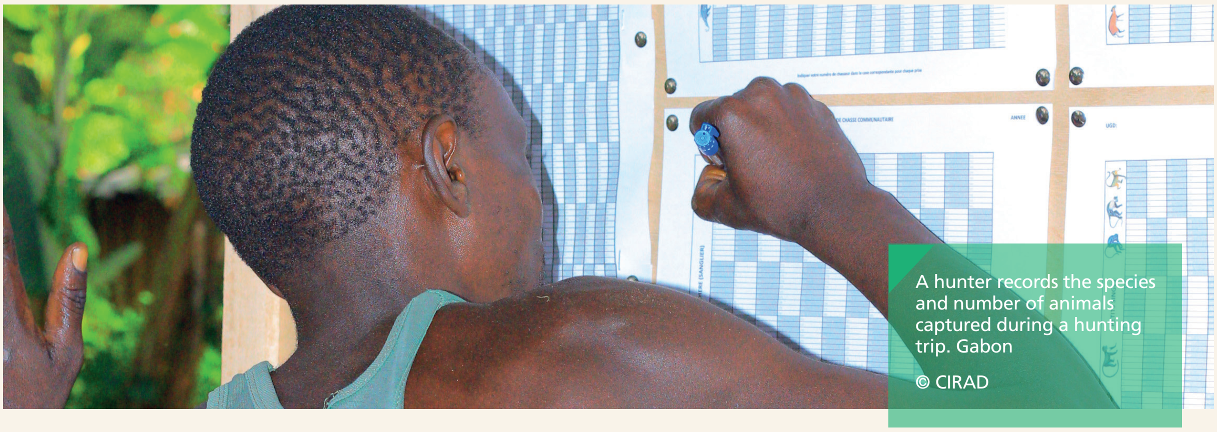
The hunting monitoring system in Mulundu was developed as part of the community engagement process associated with the SWM Programme. The monitoring of offtake represents an initial stage in the engagement process, which is of paramount importance in fostering an understanding of resource management and collective hunting rights. The legal constraints for establishing a community forest, which represents the sole avenue through which communities in Gabon can secure formal rights to exploit wildlife, constituted the fundamental starting point for the elaboration of the monitoring system. Unfortunately, no specific standards were in place in the country for monitoring hunting offtakes. As a result, the SWM Programme collaborated with local communities and the Ministry of Water and Forests, the administrative body responsible for community forests, to develop a system. The programme aimed to achieve a balance between the use of informative indicators that were, at the same time, accessible to communities, and not excessively costly to produce. This entailed the screening of numerous methods for the collection of information and indicators, conducted in an iterative manner, with systematic feedback from the administrative body and the communities involved. This process fostered a collective learning experience. The weekly presence of the SWM Programme team in all the communities facilitated the establishment of the monitoring system, with the delivery of targeted training to local "paraecologists" (see below) responsible for data collection. Following the establishment of hunting associations and community hunting management plans, the monitoring system evolved, as did the indicators collected and the manner in which results were communicated. Two distinct monitoring systems were developed collectively: one comprehensive and technically detailed for cases where communities are assisted by a project; and a second, simplified system that communities can implement independently with minimal external assistance.

What indicators are monitored and which methodologies are used?

In the comprehensive monitoring system, a number of indicators are calculated. The initial series of indicators document the number of members of the association, the level of payment of association fees, and the number of hunters in possession of the required legal documents. These indicators enable the bureau to establish objectives for the administration of the association. A second series of indicators is used to characterize hunting in the community. These indicators include the number of animals hunted, the number of hunters, the number of hunting parties, the number of parties tracked with a GPS, the percentage of offtake sold and the surface effectively hunted. The aforementioned indicators assist the community in evaluating the level of hunting. Finally, a series of indicators provides insights into the status of game animals within the hunting territory. This encompasses the number of species hunted within the hunting territory, the mean weight of hunted animals, the rodent/ungulates ratio and the mean number of animals or kg hunted (across all species included or of a particular species) per hunter, per hunting party, per hour spent hunting, and per km walked. These indicators assist communities in establishing collective quotas for the forthcoming hunting season. It is worth noting that this system will soon be further simplified, as recent research linked to this monitoring system has shown that two indicators from this list (mean weight of hunted animals and rodent/ungulates ratio) are the most relevant for describing changes (degradation or recovery) in hunted wildlife assemblages (Fonteyn *et al*. 2024).

How are data collected and stored?

In the simplified monitoring system, each hunter records the species and number of animals captured, as well as the number of hunting parties that hunter participated in. The data are recorded on paper charts affixed to signboards situated in various locations throughout the villages. The community's hunting association is responsible for encouraging hunters to declare their activities, maintaining the signboards and charts, and generating indicators of hunting at least every three months. The SWM Programme provides support to the associations in all aspects of these activities, including the refinement of the charts, indicators used and practical solutions for ease of declaration and storage of the data.



A hunter records the species and number of animals captured during a hunting trip. Gabon

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In the context of the comprehensive monitoring system, data is collected on a daily basis by paraecologists who live within the communities. Paraecologists are members of the local hunting association. The paraecologists conduct door-to-door inquiries to ascertain whether any members of the household have returned from hunting activities that day. In the event of a positive response, the paraecologists proceed to collect the pertinent data on standardized data sheets. Additionally, paraecologists provide volunteer hunters with GPS devices, which are used to document the routes traversed during hunting sessions. Subsequently, on a weekly basis, personnel from the SWM Programme collect the data sheets, and then download the data from the GPS. The data sheets are scanned and the files are read automatically by a dedicated software (using optical character recognition), which populates a database. A series of quality control procedures are in place to ensure the accuracy and reliability of the data collected. The system also features automatic generation of indicators from the database. The data sheets are returned to the communities for storage, while a copy is retained by the programme. The utilization of data is formalized through an agreement between the supporting project and the community, which adheres to the principle of FPIC and the general data protection regulation (GDPR).

How are results communicated?

In the simplified monitoring system, the association's bureau collates the data recorded on the public charts every three months and calculates the relevant indicators. The outcome of this process is then presented to all members of the association at the general meeting where management decisions are made. At the conclusion of the annual cycle, the accumulated data is employed to update the community's quotas, which the community then imposes on itself for the subsequent hunting season. The decision is then incorporated into the hunting management plan.

In the context of the comprehensive monitoring system, the indicators are presented in a document designated as an "info-service", which is intended for dissemination to the communities. The format of this document is designed to convey the information needed in the simplest way for optimal appropriation by the communities: when relevant, graphical representations of indicators are preferred, and all indicators and the way to interpret them are explained in plain text. Additionally, the info-service incorporates a dedicated section in which the community can present its interpretation of the data. The document concludes with an invitation to the community to formalize its own objectives for the following year in relation to association management, hunting and quotas. The info-service therefore constitutes an integral component of the community hunting management plan. All resolutions are subject to ratification by the association's general meeting.

Once integrated into the community's hunting management plan, the indicators and decisions are shared with the administration. Authorities then oversee the management of the community forest to ensure it is appropriate.

What were the major difficulties encountered and how were they addressed?

The criminalization of hunting in Gabon over several decades, coupled with pervasive corruption, has led hunters in rural communities to resort to informality and secrecy. Establishing trust among individuals within the community proved to be a significant challenge. Hunting has been an individual activity in Gabon for a considerable length of time. The traditional regulations of the activity has now become largely ineffective, and the primary challenge was to re-establish hunting as a collective endeavour. When the SWM Programme arrived in Mulundu, there was a considerable degree of distrust between the local communities and the decentralized administration. The neutral status of the programme, which was initially met with scepticism from local communities, ultimately proved to be a crucial factor in facilitating change. As the monitoring system required transparency, it was of the utmost importance to establish trust toward the programme. The sustained presence in the village, adherence to the formal FPIC protocol, and tangible outcomes that had an immediate impact on the lives of hunters were pivotal in fostering trust. The process commenced with the recruitment of individuals to the role of paraecologists. Subsequently, these individuals assumed the role of champions, facilitating the adhesion of other individuals to the programme's objectives. Following a period of trust building, it became possible to involve the communities alongside people from the local authorities in projects with positive impacts on communities. This entailed, in particular, the declaration of damages to crops that had been destroyed by wildlife, which ultimately resulted in the State's payment of compensations to farmers. There was a notable enhancement in the relationship between the communities and the local authorities.

The data recorded on the public charts are used to calculate relevant indicators, which are then presented to all members of the hunting association

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Case study 4

Community-based monitoring system for research on wild meat sanitary conditions in Cameroon

What is the objective of the sanitary monitoring system?

To effectively address the complex public health challenges associated with wild meat consumption in rural tropical forest regions, establishing a well-designed monitoring system focusing on sanitary supervision is essential. In these areas, subsistence hunting is crucial for food security. Wild meat is often processed in inadequate conditions where carcasses are dressed in the forest or backyards in villages. The lack of regulation and veterinary oversight makes it extremely difficult to assess health risks. Therefore, it is crucial to set up basic inspection systems that can improve safety standards of the meat consumed. These inspections are essential for spotting hazards and making sure food safety rules are followed, thus protecting public health. To overcome these challenges, we implemented a pilot community-based wild meat sanitary system encompassing our SWM Programme-Cameroon field team, community members and a team of associated veterinarians.

What was the development process?

Our primary goal was to establish a community-based sanitary system that educates and empowers local communities to improve food health standards. We achieved this by conducting tailored workshops and ongoing education initiatives, and engaging community members in effective, low-cost inspections of wild meat intended for consumption. This training equips them with the skills necessary to detect potential health hazards in the meat and internal organs of hunted animals. To develop this system, we conducted extensive consultations and workshops with the target communities. Through this participatory approach, we aimed to fully understand local priorities and challenges associated with wild meat consumption. By doing so, we ensured that our system was in line with the sociocultural context and effectively met the needs of the community.

What indicators are monitored, and which methodologies are used?

Village Reporters (VRs) are literate community members willing to join the project. They are trained in sanitary inspection and biological sampling, working closely with hunters to monitor critical indicators of meat quality and health risks from hunted animals. They adhere to standardized protocols for sample collection and sanitary inspections. These inspections focus on identifying anomalies in fresh meat, including unusual colouration (e.g. green or brown), unpleasant odours or slimy textures, which may indicate spoilage or contamination. They also actively search for macroparasites visible to the naked eye, which pose potential health risks to consumers. In addition to visual inspections, VRs are trained to conduct field necropsies of thoracic and abdominal organs to detect histopathological lesions. These lesions, found in organs like lungs, liver and stomach mucosa, provide important clues about potential diseases that could affect human health through consumption of contaminated meat. Biological sample collection is a crucial aspect of VRs' work. They gather various samples including blood, swabs from mucosal surfaces, small muscle tissue pieces and entire viscera. These samples are preserved and later analysed in associated laboratories to detect pathogens and assess overall meat quality and safety. Regular monitoring and supervision by project coordinators and veterinarians ensure the quality and reliability of data collected.

Community Village Reporters identifying anomalies found in meat and recording them during a training session

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How is data collected and stored?

VRs were trained to conduct thorough inspections of carcasses brought in by hunters, documenting findings using standardized data sheets designed for recording sanitary indicators. They were equipped to safely collect biological samples without cross-contamination, following strict hygienic practices. VRs identified signs of food-borne illnesses such as anomalies, histopathological lesions and macroparasites, indicating potential health risks. This collection of biological samples aimed to enhance pathogen diagnostic capabilities while ensuring sample accuracy and safety through careful meat handling practices. Training sessions for the monitoring system were conducted semi-annually, involving hunters, VRs, the veterinary groups and the project field team. VRs underwent extensive training over three weeks, supplemented by ongoing education during the sample collection phase. The training focused on developing comprehensive skills in sanitary inspection techniques and maintaining good hygienic practices essential for handling wild meat. During the inspection process, VRs met hunters upon their return to the community to assess carcasses together. They conducted sanitary inspections, documenting any signs of illness or parasites, which were photographed as evidence. When necessary, VRs collected and recorded biological samples for subsequent pathogen diagnosis, ensuring optimal sample preservation. This streamlined approach maximized the collection of critical biological and ecological evidence, leveraging local community expertise.

Biological sample collection included blood samples on filter paper for genetic and pathogen analysis, rectal and oral swabs for mucosal pathogen detection, small muscle tissue pieces for tissue-level investigations, and entire viscera for organ health assessments and parasite identification. Each sample type was carefully collected to provide a comprehensive array of biological material for thorough examination. Stringent storage protocols ensured sample integrity. Viscera samples were preserved in 4 percent formaldehyde solution for tissue structure preservation. Swab samples were stored in DNA/RNA Shield solution in Eppendorf tubes to protect genetic material. Helminths were washed in saline and stored in 70 percent ethanol to preserve morphology, while blood samples were dried and preserved on FTA cards in sealed, labelled bags with desiccants to prevent moisture damage during transport and storage.

How are results communicated?

As part of our ongoing efforts, we are developing two versions of the "Sanitary Inspection and Good Hygienic Practices Manual". One version is tailored for wild meat users, helping them recognize potential health risks and adopt safe practices. The second version targets practitioners, offering detailed guidelines on conducting thorough sanitary inspections and meeting health standards. To foster knowledge sharing and community engagement, sample analysis results will be disseminated through national, regional and local workshops involving community members and stakeholders. These workshops will provide platforms to discuss findings, address concerns and develop strategies to improve food safety and health in wild meat consumption. These initiatives aim to enhance local capacity in sanitary practices and empower communities to manage their health and environment effectively. Through collaborative learning and ongoing feedback, the goal is to strengthen the sustainability and impact of the monitoring system in safeguarding public health and promoting responsible wildlife management practices.

What major difficulties were encountered and how were they addressed?

One of the main challenges we face when scaling up our system is to guarantee access to running water and suitable storage facilities, especially for maintaining the necessary cold chain for food safety. Without reliable access to running water, it becomes difficult to maintain cleanliness and sanitation standards. Strategies to consider may include improving infrastructure by installing water supply systems and providing training on alternative hygienic practices for situations where running water is not available.

Village Reporters are trained in sanitary inspection and biological sampling and work closely with hunters to monitor critical indicators of meat quality and health risks from hunted animals

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@ NACSO/WWF in Namibia

Case study 5

Community-based monitoring in Namibian conservancies to inform national trophy hunting and community own use quotas

What is the objective of the monitoring system?

Namibia's community based natural resource management (CBNRM) programme is a joint venture between government, national Non-Governmental Organizations and rural communities. Initiated more than 30 years ago, this programme involves communities in monitoring several aspects of their conservancy, including wildlife numbers, economic returns, patrolling records and non-compliance with established rules. Communities use a paper-based system, the event book, where a community decides what needs to be monitored. Scientists facilitate the design process, while trained conservancy members undertake all data analysis. The system is implemented across different communal conservancies and National Parks, but the information is also compiled at the national level and shared with the Ministry of Environment and Tourism (MEFT). The data is used by the Government and the NACSO for strategic decision making such as guiding quota setting, allocation of technical support, and compliance monitoring. Given the need to generate useful information at different levels, there is some level of national standardization in terms of the information being collected, but each conservancy may, in addition, collect information on locally relevant topics of interest. Each year data are copied during an annual review of each conservancy and are captured within a national monitoring and evaluation database.

What was the process for its development?

The quota-setting process for Namibian conservancies was established through a collaborative and iterative approach involving multiple stakeholders to ensure sustainable wildlife management. Initially, the process was developed in response to the need for structured and regulated use of wildlife resources within conservancies. This involved extensive consultations with local communities, conservation organizations and government agencies, particularly the MEFT which drives this process at national level. The foundational framework was built on scientific principles and CBNRM practices. Key elements included the implementation of the event book system for data collection, the establishment of annual game counts, and the integration of traditional knowledge with scientific research. Guidelines and protocols were created to standardize data collection, ensuring consistency and reliability across conservancies. Training programmes were conducted to equip game guards and community members with the necessary skills for accurate data recording and monitoring. The NACSO Natural Resource Working Group (NRWG) played a crucial role in consolidating and analysing the collected data, facilitating the transition from raw data to informed decision making. Over time, the quota-setting process has evolved, incorporating advances in technology, such as remote sensing, and continuous feedback from the field to refine and improve its effectiveness.

Ground counts provide crucial data on wildlife populations as part of the CBNRM process in Namibia

© WWF Namibia/Matthew Walters

What indicators are monitored and, which methodologies are used?

The quota-setting process is a yearly data-driven practice aimed at ensuring sustainable wildlife management and conservation. Key indicators are systematically monitored to inform decision making. Annual ground counts provide crucial data on wildlife populations, while the status of species is assessed using reliable sources to ensure accurate understanding of conservation status. Past quota usage and the hunting effort (reported by hunters) is analysed to gauge the availability of huntable species and offers insights into the intensity and distribution of hunting activities. Trends in trophy quality are tracked to evaluate the health and age structure of game species and the impact of trophy hunting. Veld condition, assessed through remote sensing, helps determine the carrying capacity of the habitat, ensuring that quotas align with the environment's capacity. Additionally, other monitoring methods, such as fixed route patrols and rare species monitoring, contribute valuable information on species trends and presence. This comprehensive approach ensures that quotas are set based on a robust understanding of the ecosystem, promoting sustainable use and conservation of wildlife resources. All these data can be used as part of an index that assesses the best possible quota number that would have minimal impact upon a selected species population for a conservancy. This exercise also considers the fact that multiple species will typically move from conservancy to conservancy, and, therefore, the quotas for neighbouring conservancies are set as a “shared resource”.

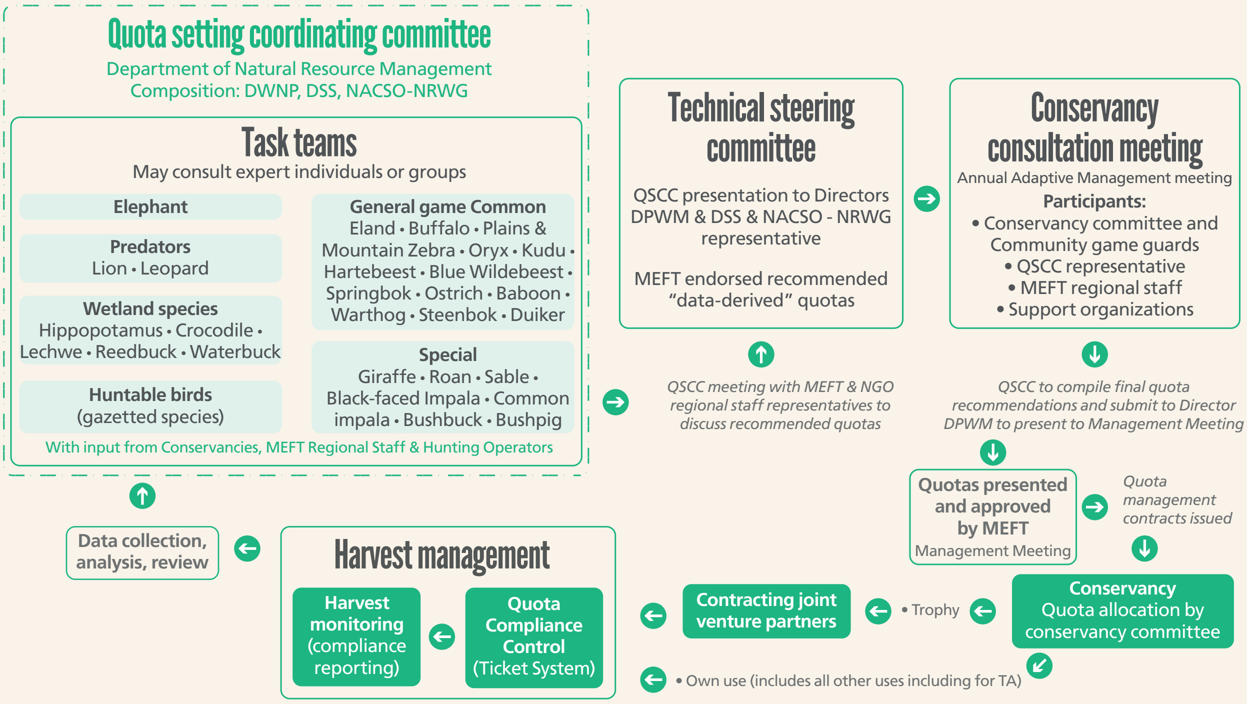
How are data collected and stored?

Data collection and storage is managed systematically as part of an adaptive management loop. Some conservation hunting data are integrated into the event book system: game guards accompany hunts and record details of trophy and own-use offtake in a set hunting book, which is then used to populate the Wildlife Introductions and Removal Book at the conservancy office. Game guards also use the event book system to gather data during fixed route patrols and rare species monitoring. All collected data are summarized during the Event Book Audit process and subsequently entered into a central Microsoft Access-based database, typically referred to as CONINFO. Species population numbers and trends are estimated through annual game counts, with conservancy members walking line transects (applying distance sampling methodology). River counts and waterhole counts are occasionally employed to enhance the population trend data for certain conservancies. The NRWG collects game count data and event book audit data and uploads them to the central database, which has been set up to automatically populate a quota-setting Excel spreadsheet for each conservancy. Other data sources are independently obtained: trophy quality and hunting effort data are collected from the MEFT permit office, and remote sensing data are gathered by the NRWG GIS team. Other relevant data from researchers studying species of interest is integrated at a task team level of the quota-setting process and sourced once the quota-setting process begins.

How are results communicated?

Typically, there are two levels of results communication. First, results are presented to conservancy members at their annual general meeting and adaptive management feedback sessions, with facilitators from support organizations and government presenting the conservancies with their data to better inform decision-making processes. The conservancy committees are then responsible for presenting these results to other conservancy members at village, general and annual general meetings. The second level relates to the quota-setting process itself, where MEFT regional staff, with input from the quota-setting technical steering committee, will meet with the conservancy committee to present the calculated quota for their conservancy. During this process, the committee and conservancy staff will verify the numbers of the set quota and in certain cases will give recommendations on the quotas set.

Figure 8. Quota setting cycle


Quota setting coordinating committee
Department of Natural Resource Management
Composition: DWNP, DSS, NACSO-NRWG
Task teams
May consult expert individuals or groups
Elephant
Predators
Lion • Leopard
Wetland species
Hippopotamus • Crocodile • Lechwe • Reedbuck • Waterbuck
Huntable birds
(gazetted species)
General game Common
Eland • Buffalo • Plains & Mountain Zebra • Oryx • Kudu • Hartebeest • Blue Wildebeest • Springbok • Ostrich • Baboon • Warthog • Steenbok • Duiker
Special
Giraffe • Roan • Sable • Black-faced Impala • Common impala • Bushbuck • Bushpig
With input from Conservancies, MEFT Regional Staff & Hunting Operators
Technical steering committee
QSCC presentation to Directors DPWM & DSS & NACSO - NRWG representative
MEFT endorsed recommended "data-derived" quotas
QSCC meeting with MEFT & NGO regional staff representatives to discuss recommended quotas
Conservancy consultation meeting
Annual Adaptive Management meeting
Participants:
• Conservancy committee and Community game guards
• QSCC representative
• MEFT regional staff
• Support organizations
QSCC to compile final quota recommendations and submit to Director DPWM to present to Management Meeting
Quotas presented and approved by MEFT
Management Meeting
Quota management contracts issued
Conservancy
Quota allocation by conservancy committee
• Trophy
Contracting joint venture partners
• Own use (includes all other uses including for TA)
Harvest management
Harvest monitoring (compliance reporting)
Quota Compliance Control (Ticket System)
Data collection, analysis, review

What were the major difficulties encountered and how were they addressed?

	Challenge	Addressing the challenge
Data accuracy and availability	Insufficient and sometimes unreliable data on wildlife populations make it difficult to set accurate and sustainable quotas. This is particularly true for carnivores, huntable bird species and certain wetland antelopes.	Efforts have been made to improve data collection methods, such as involving community game guards and using technologies like aerial surveys, camera traps and waterhole counts. Researchers also contribute information on wildlife population estimates to independently verify the status of certain species.
Community involvement and governance	Ensuring effective and inclusive community participation in the quota-setting process can be difficult, particularly in larger or more diverse conservancies.	Strengthening governance structures and promoting transparency and accountability within conservancies helps ensure more inclusive decision-making processes. Regular community meetings and consultations also enhance participation. Several government and non-government interventions have also been enacted to strengthen the governance capacity of conservancies.
Conflicts of interest	Conflicts can arise between different stakeholders, such as between conservation goals and community need for income from hunting. In some scenarios, conservancies might advocate for a higher quota of rare, high-value species, or regular plains game to benefit from higher trophy fees and/or meat distribution.	Developing clear and fair benefit-sharing mechanisms and ensuring that quota-setting decisions consider both conservation and livelihood objectives are crucial in mitigating these conflicts. Only through the strengthening of facilitation techniques for quota-setting sessions can committee members be made aware of current offtake trends, the market viability of certain species based on current trophy quality and population estimates, and climatic variations that could influence the sustainability of the quotas.
Poaching and illegal wildlife trade	Poaching and illegal trade can undermine the effectiveness of the quota system by reducing wildlife populations beyond sustainable levels. In some instances, the poaching of elephants alongside trophy hunting can further reduce the trophy quality trend and lead to a market reduction.	Strengthening anti-poaching measures, increasing patrols and enhancing community-based monitoring can reduce illegal activities. Collaboration with law enforcement agencies is crucial: game guards always report poaching incidents to the police and MEFT. Some conservation initiatives have also targeted key monitoring interventions for species of interest (i.e. elephant, lion, etc.), which helps to increase general oversight within certain landscapes. Finally, a collaborative network among MEFT, the police, customs and the Judiciary has helped curtail IWT activities within Namibia in the past five years.
Climate change and environmental variability	Changing environmental conditions and extreme weather events can impact wildlife populations, making it challenging to set stable quotas. This is particularly true within conservancies of the Kunene, Erongo, Kharas and Hardap Regions (drought-prone regions of Namibia).	Incorporating adaptive management practices and regularly reviewing and adjusting quotas based on the latest environmental data can help address this issue. Additionally, strategies that can help with wildlife population recovery should be collaboratively developed and understood.

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The Sustainable Wildlife Management (SWM) Programme is a major international initiative that aims to improve the conservation and sustainable use of wildlife in forest, savannah and wetland ecosystems. It is being funded by the European Union with co-funding from the French Facility for Global Environment (FFEM) and the French Development Agency (AFD). Projects are being piloted and tested with governments and communities in 15 participating countries. The initiative is coordinated by a dynamic consortium of four partners, namely the Food and Agriculture Organization of the United Nations (FAO), the Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF), the French Agricultural Research Centre for International Development (CIRAD) and the Wildlife Conservation Society (WCS).

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